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## DISTURBANCE IN EPISODIC MEMORY IN PATIENTS WITH INFLAMMATORY BOWEL DISEASE

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### SUMMARY

#### Background:

Crohn's disease (CD) and ulcerative colitis (UC) belong to a group of Inflammatory Bowel Diseases (IBD). The most common symptoms are chronic diarrhoea, weakness, loss of weight, and chronic gastralgia (belly-aches). Beside somatic symptoms mild cognitive disturbances are observed in IBD patients. The most prominent are memory disturbances. The aim of the present work was to evaluate the occurrence of episodic memory disorders in IBD and to determine its profile as an index of the cognitive functions decrease.

#### Material/ Methods:

The experimental group consisted of 30 patients (14 women and 16 men) aged 23 to 47 (mean age was  $34.15 \pm 8.34$ ) with a diagnosis of Inflammatory Bowel Disease treated at the Gastroenterology Clinic of the 2<sup>nd</sup> University Hospital in Bydgoszcz. The patients with symptoms of deep depression and dementia as assessed by the Mini Mental State Examination (MMSE) were excluded from the study. The control group included healthy persons matched for the sex and age. Two tests were administered: Logical memory scale from WMS-III (Polish version) and the Hospital Anxiety and Depression Scale – (HADS). An analysis of the scores revealed a mild decrease of cognitive functions in all 100% patients of the examined group. This was expressed in the case of attention (in 50% of patients) as well as memory (in 100% of patients). At the same time the examined patients showed mild anxiety symptoms.

#### Results:

#### Conclusions:

It is important to draw the attention of medical staff and family member to the occurrence of cognitive disorders in IBS patients, and the consequent communication problems. This creates the need to include elements of cognitive rehabilitation in the process of IBS patient treatment.

**Key words:** Crohn's disease, cognitive functions, anxiety

## BACKGROUND

Crohn's disease (CD) and Ulcerative colitis (UC) belong to the group of inflammatory bowel diseases (IBD). This is a disease is cancerous in nature, and one that often has its origins at a young age. The incidence of IBD in Europe is around 10 cases per 100,000 per annum. There has been observed in recent time an increase in the frequency of both CD and UC. According to British data the number of cases of IBD incidence will double every ten years (Ghosh & Mitchell, 2007).

The symptoms of IBD include: chronic diarrhoea, weakness, body weight loss, chronic stomach pains. The quality of the symptoms together with their chronic, cancerous nature influence the weakening of patient activity in the social, educational, professional and family spheres, something that is linked to a significant lowering in the quality of life (QoL) (Greenley et al, 2010). The results of tests carried out point to a marked reduction in the quality of life amongst patients suffering from IBD when compared to healthy individuals (Ghosh & Mitchell, 2007; Wexner & Frattini, 2010; Scarpa, 2010; Cohen, 2002). The quality of life of IBD patients is affected by an array of factors directly connected with the course of the disease, for example the activity of the disease or the type of treatment employed. Nonetheless taken into consideration need to be that IBD affects usually those of a young age, while a significant lowering in the quality of life is affected also by many psycho-social factors (Wexner & Frattini, 2010; Cohen, 2002; Guthrie et al, 2002), including the cooccurrence of symptoms of depression, something that is often a frequent symptom in this group of patients (Kovács & Kovács, 2007; Greenley et al, 2010; Mackner & Crandall, 2006; Szigethy et al, 2004).

The lowering of IBD patient quality of life may be also connected with the presence of cognitive deficiencies. For in recent time attention has been drawn to the appearance of disturbances in the cognitive functions of patients with IBD, particularly in the period of disease intensification. However, tests into this problem area are noticeably few (Attree et al, 2003; Dancy et al, 2009).

Tests into the cognitive functioning of individuals with IBD point to the appearance of mild cognitive disturbances within this group of patients (Greenley et al, 2010). Amongst those cognitive functions which are exposed to frequent disturbance at the early stage of the disease is memory. One of the most sensitive indexes of mild cognitive disturbances (MCI) is a lowered episodic memory ability (Storandt & Hill, 1989). The aim of the present work is an evaluation of the appearance of disturbances to the episodic memory in patients with IBD as well as the defining of the profile as an index of a lowered cognitive functioning.

## MATERIAL AND METHODS

The test group constituted 30 patients (14 women, 16 men) aged from 23 to 47 (average age  $34.15 \pm 8.34$ ) with diagnosed inflammation of the bowels, who had been hospitalised at the 2<sup>nd</sup> University Hospital Gastroenterology Clinic in Bydgoszcz, Poland, as a result of an intensification of the disease. The exclusion

criteria were as follows: age > 50 lat, the presence of neurodegenerative diseases during interview, the confirmation of features of dementia confirmed in the screening test (MMSE), the presence of deep anxiety-depression disturbances.

The control group was made up of healthy volunteers (14 women, 16 men), who paired off with the patients in the test group in terms of age, sex and education.

The demographic and clinical characteristics of the test and control group are presented in Table 1.

We made use of the following research instruments during our tests:

- **Mini Mental State Examination (MMSE)** – a short test of a patient’s mental state (MMSE), as a screening test serving to evaluate disturbances in the cognitive functions. MMSE is composed of 30 questions/tasks allowing one to conduct a quantitative evaluation of various aspects in cognitive functioning. Within the composition of areas subjected to evaluation are: Orientation in time, Orientation in space, Remembering, Attention and Counting, Recalling, Naming, Repeating, Understanding, Reading, Writing and Drawing.
- **HADS (Hospital Anxiety and Depression Scale)**. HADS is a self-evaluation scale. This scale has two sub-scales: for fear/anxiety and depression and is a widely employed screening instrument for the evaluation of these states.
- **LOGICAL MEMORY from the WMS-III battery** (Polish language version by Pačhalska & Lipowska, 2006) this test measures the capability of episodic memory, that is the ability to remember and recall events and situations which create a consecutive logical sequence. This test involves two short stories, which the tested party has to create immediately and after a period of time has elapsed. In addition the second story is repeated twice to allow for a greater likelihood that the patient will learn it during the test’s immediate phase as it would be difficult to evaluate the degree of memorised material over a longer time period if the testee was only to have learned it to a limited degree during the immediate phase (Wechsler 1998; Lipowska 2011).

The results of immediate recreation allowed for the following indexes to be calculated:

- Instant aural memory – defines the ability to remember information directly after its oral presentation
- The total evaluation of aural narrative and thematic memory – defines the ability to remember word-for-word also thematic logical verbal material
- Learning index – defines the ability to acquire new aural information after a repeated contact with the material, and serves to measure the relative increase in the ability to create between subsequent attempts.

After the elapsing of 30 minutes the patient creates from memory (without prior repeating) both stories. In addition the patient answers 30 questions of the true/false type relating to important information in each text.

The second phase allows for the calculation of indexes of:

1. memorisation – defines the capacity of revitalised memory as a function of instant memory capability following the elapsing of around 30 minutes,

2. word-for-word and thematic creation with adjournment – defines the ability to create after a break word-for-word and thematic verbal logical material,
3. reproduction – serves to compare the ability to create information from memory in two cases: material reproduction and recognition.

## RESULTS

An analysis of the results obtained from the screening test of cognitive functions showed that 100% of those from the test group had a slight reduction in cognitive functions. Of note is the fact that lowered were exclusively those results obtained on the sub-scale connected with attention (in 50% of those tested) and memory (in 100% of those tested).

There occurred somewhat more often anxiety disturbance (mild and moderate) than was the case with depression. The results of the MMSE and HADS screening tests are presented in Table 2.

Despite the fact that 33.33% of the patients tested made use of psychological help, none of them had been referred to a neuropsychologist. What is more there is an absence in the patients' consciousness of existing cognitive functions disturbances. In response to the question as to whether the patient has memory or attention disturbance, 70% answered that they had none.

An analysis of the results obtained in the Logical Memory test is presented in Table 1.

On the basis of the analysis conducted it was stated that there were significantly lower results in the range of instantaneous aural memory in the patient group when compared to the control group.

A subsequent comparison concerned narrative and thematic aural memory. The index of narrative aural memory is the level of word-for-word reproductions from the stories, while thematic aural memory defines the recollection of information only, without which the thematic thread would lose meaning. It was shown in the analysis conducted that individuals with IBD reproduced significantly less word-for-word information as well as more often losing the important thematic threads.

Table 1. Demographic and clinical characteristics of the test and control group

	<b>Test Group (n=30)</b>	<b>Control Group (n=30)</b>
	Average ± SD	Average ± SD
<b>Age (years)</b>	34.15 ± 8.34 (min 23 - max 47)	34.15 ± 8.34 (min 23 - max 47)
<b>Sex (W/M, %)</b>	46 /53	46/53
<b>Education secondary higher</b>	secondary 60% higher 40%	60% 40%
<b>illness duration (years)</b>	7.83 ±10	-
<b>Type of disease</b>	Crohn's disease 60% Ulcerative colitis 40%	-

Table 2. The results of the MMSE and HADS test in the test and control group

	Test Group (n=30)	Control Group (n=30)
<b>MMSE</b>	M=26.95 ±	M= 30
<b>HADS</b>		
<b>FEAR/ANXIETY</b>		100%
<b>Norm</b>	47.06%	
<b>Mild</b>	29.41%	
<b>Moderate</b>	23.52%	
<b>DEPRESSION</b>		100%
<b>Norm</b>	76.47%	
<b>Mild</b>	17.65%	
<b>Moderate</b>	5.88%	

Legend: M - mean

Table 3. Indexs of aural memory

	Irritable bowel inflammation M±SD	Healthy M±SD	p
<b>Instantaneous aural memory</b>	22.43 ±8.34	34.10 ±4.98	p>0.000
<b>Aural memory</b>			
<b>narrative</b>	36.6 ±12.65	53.76 ±7.16	p >0.001
<b>thematic</b>	16.53 ±3.7	20.96 ±1.54	p >0.001
<b>Learning index</b>	3.83 ±3.22	4.25 ±3.75	ns
<b>Holistic evaluation of reproduction with restoration</b>			\
<b>Narrative</b>	22.36 ±9.62	35.37 ±6.4	p>0.001
<b>thematic</b>	11.03 ±2.90	13.68 ±1.09	p>0.001
<b>Percentage of remembered information</b>	80.43% ±16.72	91.43% ±9.24	p=0.003

Legend: M - the mean number of reproduced items; SD- Standard Deviation

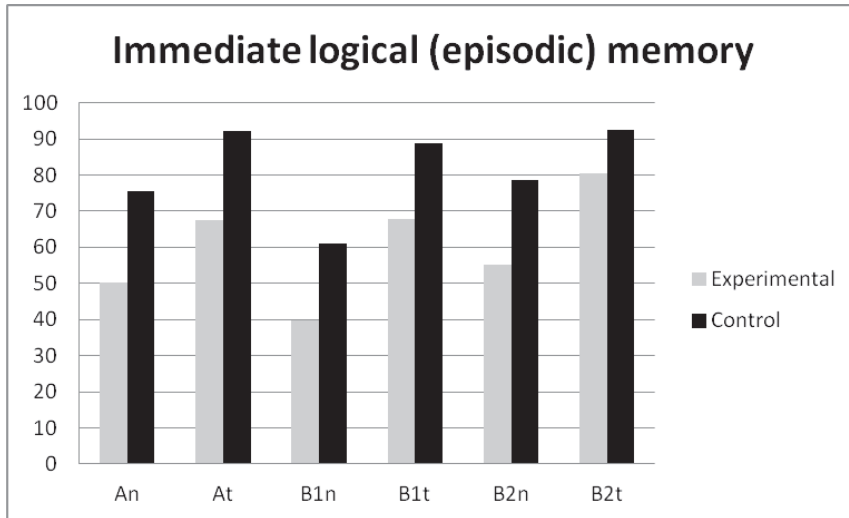
In all those tested there was observed an improvement in results together with the subsequent repetition of the material. Even though the level of material remembered was lower in the patient group when compared to the control, a similar curve for learning was obtained in both groups. The results obtained are shown in Figure 1.

The next index analysed referred to learning (Table 2) and described the ability to learn new aural information after a repeated contact with the material. This index is used to measure the relative increase in the ability to recreate across the subsequent attempts. There have not been noted any significant statistical differences in learning between the test group and the control.

A further step was the comparison of the index evaluating the percentage of information remembered, which is a measure of the capacity of a revived memory, that is the amount of recreated information from both stories following a 20-minute period of adjournment. The statistical analysis showed that the percentage of information remembered is for those with IBD significantly lower when compared to the control group. IBD patients forgot a greater part of the material then did their healthy peers. The lowered level of this index is most char-

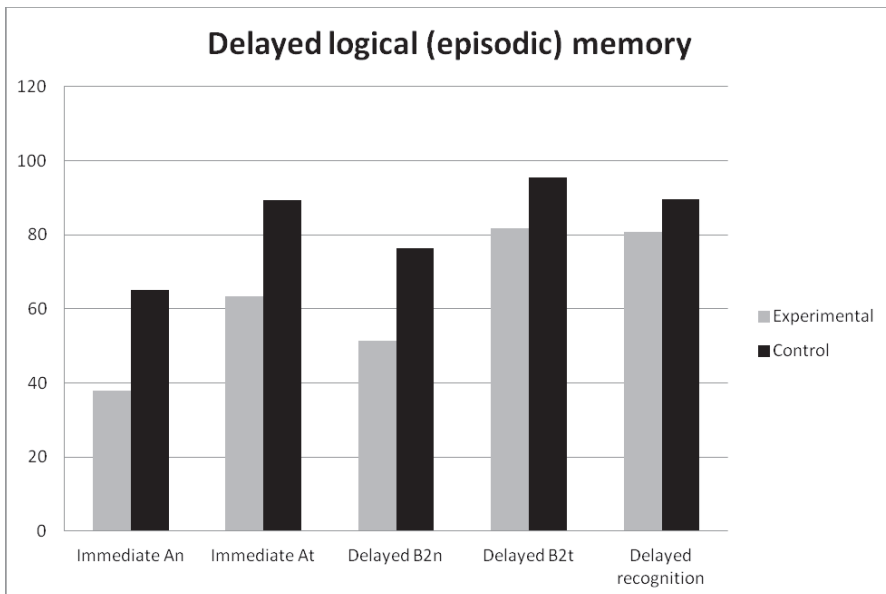
acteristic in relation to individuals with neurodegenerative disturbances/impairments (Olszewski, 2008).

An analysis of the results of revitalised aural memory has also shown significantly lower results in the test group than in the control while the profile for recre-



Legend: An – story A, narrative units; At – story A, thematic units; B1n – story B1, narrative units; B1t – story B1, thematic units; B2n – story B2, narrative units; B2t – story B2, thematic units.

Figure 1. Immediate logical (episodic) memory – the learning profile



Legend: An – story A, narrative units; At – story A, thematic units; B2n – story B2, narrative units; B2t – story B2, thematic units.

Figure 2. Delayed logical (episodic) memory: percentage of recreated units

ation was the same in both groups (Figure 3). This means that episodic memory revitalised in the group of IBD patients is not impaired. In both groups one may observe a significant fall in the recreation of narrative units in the first story (for the test group  $p=0.003$  and for the control  $p=0.001$ ) yet there was not observed a significant fall in the remembered thematic units i.e., in the sense (meaning) of the information remembered.

The final dimension to be analysed was recognition (Table 2). In this sub-test the patient had to answer 30 questions of the true/false type referring to both stories. There was not noted any significant differences in terms of the percentages of information recognised between the patient group and that of the control (80.83% vs. 89.53%, ns).

## DISCUSSION

To date there has not been established an unequivocal link between IBD and the appearance of disturbances to cognitive functions. In the subject literature available there exists data which points to the existence of such a dependence, although to date there have not been many research works into this problem area.

The tests show that patients with IBD obtain worse results in the tests evaluating verbal functioning (test measuring verbal functioning) when compared to healthy individuals. However, there have not been noted differences in tests evaluating attention and the speed of mental processes (Attree et al, 2003; Dancy et al, 2009).

On the other hand there exist reports which do not substantiate this thesis. In the observed test conducted by Berril et al. (2015) covering 150 patients with IBD, 40 patients with irritable bowel syndrome (IBS) and 41 healthy volunteers, there were not noted any significant differences within the range of cognitive functioning for those who were ill and those healthy, after taking into consideration existing disturbances to mood and the level of education. The length of the disease as well as disease activeness did not affect the cognitive functions of those with IBD. In the research conducted by us there were noted difficulties in recollection in 100% of those tested, while 50% claimed a reduced index of attention and this just on the basis of the MMSE screening test. The results of earlier published research evaluating the functioning of memory in those with IBD concerned chiefly aural memory. The research instruments used were: the Auditory Verbal Learning Test and the Paced Auditory Serial Addition Task. Test results showed a moderate/mild disturbance in verbal memory equally amongst young people with IBD (Castaneda et al, 2008). Episodic memory has not hitherto been analysed in those with IBD, yet it is connected with the correct remembering of an announcement in social interaction. In the test group of those with IBD, in comparison with those who are healthy, there was noted a reduction in this memory measurement. The Logical Memory test from the WMS-III battery was utilised to test episodic memory in its authorised Polish-language version

(Pačalska & Lipowska, 2006).

In the test group lower results were noted for instantaneous aural memory when compared to the control group. Difficulties in this type of remembering may point to a deficit in the pre-attentive buffer. (Brown & Pačalska, 2003).

Those with IBD recreate significantly less word-for-word information as well as more often losing important thematic currents, which may point to the fact that those being tested have difficulties in understanding and remembering the meaning of contents heard.

The most differentiating trait is the holistic evaluation of the recreation of narrative units with adjournment. Less differentiating though still significant indexes of the functioning of episodic memory in individuals with IBD and healthy individuals turned out to be recognition, the index of learning as well as the percentage of information remembered.

The causes of confirmed cognitive disturbances, including those of memory, have not been entirely explained. In those suffering from IBD several factors have been confirmed which could result in the development of cognitive disturbances. The results of research show, among other things, a connection between depression, which is a common phenomenon within this patient group, and cognitive disturbances (Castaneda et al, 2008; Gualtieri et al, 2006).

Castaneda et al. (2008) have shown, however, an absence of a significant connection between the presence of mild depression-anxiety symptoms and disturbances in verbal memory. Therefore in order to exclude the effect mood disturbances on the results of memory tests we have excluded in the tests we conducted those with severe depression-anxiety disturbances as evaluated by means of the HADS scale.

It is important to note the results of laboratory research in those with IBD. There exist studies on the subject of the connection between cognitive deficits and lowered levels of haemoglobin. In turn other researchers show that higher inflammation state parameters such as CRP or those of certain cytokines may also affect a deterioration in cognitive functions.

During the course of the last five years attention has started to be focused on the important role played by the intestines on the brain. M. Gershon (1999), who defined the bowels as the 'second brain,' estimated that there are to be found in the intestines around 100 million neurons, that is less than in the brain yet more than in the spinal cord or peripheral nervous system. Both nerve systems constantly send each other signals by means of the vagus nerve.

The vagus nerve runs from the intestines through the diaphragm, misses the heart, lungs and oesophagus and enters many parts of the brain, including the limbic system, the insular cortex, the amygdale or the hippocampus and also to the prefrontal cortex. The connection with these areas as equally the brain-intestine axis link with the cholinergic route may explain the occurrence of memory problems in those suffering from IBD (Chen et al, 2013).

The connection between the functioning of the intestines and that of the brain has been also shown by Irish researchers, who for several weeks gave prepa-



rations to mice which contained microorganisms beneficial to the bacterial flora of the intestines, and then subjected the rodents to various experiments checking cognitive functions. The results were startling: the mice with a 'supplemented' alimentary system displayed enhanced determination, possessed lower stress hormones in their blood and achieved better orientation test results. They were also more motivated and in addition learned things better and had better memories than the mice from the control group.

Equally described has been the influence of intestine bacteria on changes in the myelin – the fatty neurolemma of nerve cells – representing a kind of insulation for neurons. Demyelination's problems have, in turn, an effect on a deterioration in the speed and quality of information transferred and consequently on a lowering of cognitive functions (Chen et al, 2013; Montiel-Castro et al, 2013; Foster & McVey Neufeld, 2013).

Of note is the fact that the presence of cognitive impairment is not always noticed by patients with IBD. In the interview conducted with the patients not one stated that they had memory impairment though many pointed to difficulties in maintaining attention during the period of the disease's intensification. This may cause the patient marked discomfort and consequently reduce their quality of life.

It is important to make IBD patients aware, as with members of their family and medical personnel involved in the treatment of the patients, of the possibilities of the manifestation of cognitive impairment, including that of memory in patients with IBD and also their potential influence on problems of interpersonal communication, particularly in the most intense phase of the disease and the inclusion within the treatment process of elements of cognitive rehabilitation for these patients; something which in an important way would improve everyday functioning and consequently the patient's quality of life.

## **CONCLUSION**

1. In the IBD test group when compared to that of healthy individuals there was noted a decrease in logical memory, evaluated during the most intense period of the disease.
2. The most distinct feature is the holistic evaluation of the recreation of narrative units with an adjournment. Less distinctive indexes turned out to be recognition, the learning index and the percentage of information remembered.
3. An evaluation of the cognitive functions in patients with IBD when in remission requires further research as does the evaluation of the correlations in the results obtained, for example with the enhanced process of inflammation or the level of CRP or selected inflammatory cytokines.

## **REFERENCES**

- Ahlman H., Nilsson O. (2001) The gut as the largest endocrine organ in the body (pdf). *Annals of Oncology* 12 (Suppl. 2): S63-S68, dostep 22.06.2015.
- Attree E.A., Dancy C.P., Keeling D., Wilson C. (2003) Cognitive function in people with chronic illness: inflammatory bowel disease and irritable bowel syndrome. *Appl Neuropsychol*; 10: 96-104.

- Berrill J.W., Gallacher J., Hood K., Green J.T., Matthews S.B., Campbell A.K., Smith A. (2013) An observational study of cognitive function in patients with irritable bowel syndrome and inflammatory bowel disease. *Neurogastroenterol Motil*. Nov; 25(11): 918-e704.
- Bonaz B. (2013) Inflammatory bowel diseases: a dysfunction of brain-gut interactions? *Minerva gastroenterologia e dietologica*. 2013 Sep;59(3):241-5.
- Brown J.W. & Pačhalska M. (2003) The symptom and its significance in neuropsychology. *Acta Neuropsychologica*.1(1):1-11.
- Castaneda A.E., Tuulio-Henriksson A., Aronen E.T., Marttunen M., Kolho K. (2013) Cognitive functioning and depressive symptoms in adolescents with inflammatory bowel disease. *World J Gastroenterol*; 14, 19 (10): 1611-7.
- Castaneda A.E., Tuulio-Henriksson A., Marttunen M., Suvisaari J., Lönnqvist J. (2008) A review on cognitive impairments in depressive and anxiety disorders with a focus on young adults. *J Affect Disord*; 106: 1-27.
- Chen, X., Roshan S. & Seong-Tshool H. (2013) The role of gut microbiota in the gut-brain axis: current challenges and perspectives. *Protein & Cell* 4.6, PMID 23686721.
- Cohen R.D. (2002) The quality of life in patients with Crohn's disease. *Aliment Pharmacol Ther*; 16(9): 1603-9.
- Cryan, J. F.; Dinan, T. G. (2012) Mind-altering microorganisms: The impact of the gut microbiota on brain and behaviour. *Nature Reviews Neuroscience* 13 (10): 701–712.
- Dancey C.P., Attree E.A., Stuart G., Wilson C., Sonnet A. (2009) Words fail me: the verbal IQ deficit in inflammatory bowel disease and irritable bowel syndrome. *Inflamm Bowel Dis*; 15: 852-857.
- Foster, J. A.; McVey Neufeld, K. A. (2013) Gut–brain axis: How the microbiome influences anxiety and depression". *Trends in Neurosciences* 36 (5): 305–312.
- Gershon M. (1999). *The Second Brain. A Groundbreaking New Understanding of Nervous Disorders of the Stomach and Intestine*. HarperCollins.
- Ghosh S., Mitchell R. (2007) Impact of inflammatory bowel disease on quality of life: results of the European Federation of Crohn's disease and ulcerative colitis Associations (EFCCA) patient survey. *J Crohns Colitis*, 1: 10-20.
- Greenley R.N., Hommel K.A., Nebel J., Raboin T., Li S.H., Simpson P., Mackner L. (2010) A meta-analytic review of the psychosocial adjustment of youth with inflammatory bowel disease. *J Pediatr Psychol*; 35: 857-869.
- Gualtieri C.T., Johnson L.G., Benedict K.B. (2006) Neurocognition in depression: patients on and off medication versus healthy comparison subjects. *J Neuropsychiatry Clin Neurosci*; 18: 217-225.
- Guthrie E., Jackson J., Shaffer J., Thompson D., Tomenson B., Creed F. (2002) Psychological disorder and severity of inflammatory bowel disease predict health-related quality of life in ulcerative colitis and Crohn's disease. *Am J Gastroenterol*; 97 (8): 1994-9.
- Kovács Z., Kovács F. (2007) Depressive and anxiety symptoms, dysfunctional attitudes and social aspects in irritable bowel syndrome and inflammatory bowel disease. *Int J Psychiatry Med*; 37: 245-255.
- Mackner L.M., Crandall W.V. (2006) Brief report: psychosocial adjustment in adolescents with inflammatory bowel disease. *J Pediatr Psychol*; 31: 281-285.
- Montiel-Castro, A. J.; González-Cervantes, R. M.; Bravo-Ruiseco, G.; Pacheco-López, G. (2013) The microbiota-gut-brain axis: Neurobehavioral correlates, health and sociality, *Frontiers in Integrative Neuroscience* 7.
- Olszewski H. (2008) *Otępienie czołowo-skroniowe. Ujęcie neuropsychologiczne* Kraków: Oficyna Wydawnicza Impuls.
- Pačhalska M. & Kaczmarek B.L.J., Kropotov J.D. (2014) *Neuropsychologia kliniczna: od teorii do praktyki*. Wydawnictwo Naukowe PWN.
- Pačhalska M. & Lipowska M. (2006), *Skala Pamięci Wechslera (WMS-III)*. Autoryzowana Wersja Polska. Kraków: Fundacja na Rzecz Osób z Dysfunkcjami Mózgu.
- Scarpa M. (2010) Health related quality of life in inflammatory bowel disease: the impact of surgical therapy. *World J Gastroenterol*, 28, 16(40): 5024-5034.

- Storandt, M. & Hill, R. D. (1989). Very mild senile dementia of the Alzheimer's type: II. Psychometric test performance. *Archives of Neurology*, 46,383-386.
- Szigethy E., Levy-Warren A., Whitton S., Bousvaros A., Gauvreau K., Leichtner A.M., Beardslee W.R. (2004) Depressive symptoms and inflammatory bowel disease in children and adolescents: a cross-sectional study. *J Pediatr Gastroenterol Nutr*; 39: 395-403.
- Wexner S.D., Frattini J.C. (2010) Quality of life in Crohn's disease. *Handbook of Disease Burdens and Quality of Life Measures*, 2183-2189.

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